CLAIMS

1. A polymer electrolyte fuel cell comprising:

a membrane electrode assembly (26) comprising a polymer film (26A) and a pair of electrodes (26B, 26C) formed on both surfaces of the polymer film (26A);

a downstream gas supply channel (33) facing a specific electrode (26C) of the pair of the electrodes (26B, 26C);

an upstream gas supply channel (32) which supplies a reaction gas to the downstream gas supply channel (33) and is not facing the specific electrode (26C); and

a partition wall (28A) which is made from a porous material, is arranged substantially parallel to the polymer film (26A), and partitions the downstream gas supply channel (33) and the upstream gas supply channel (32).

2. The polymer electrolyte fuel cell as defined in Claim 1, wherein the upstream gas supply channel (32) comprises an upstream portion and a downstream portion, the downstream gas supply channel (33) comprises an upstream portion and a downstream portion, and the upstream gas supply channel (32) and the downstream gas supply channel (33) are disposed to cause the upstream portion of the upstream gas supply channel (32) to overlap with the downstream portion of the downstream gas supply channel (33), with the partition wall (28A) being sandwiched therebetween, and to cause the downstream portion of the upstream gas supply channel (32) to overlap with the upstream portion of

the downstream gas supply channel (33), with the partition wall (28A) being sandwiched therebetween.

3. The polymer electrolyte fuel cell as defined in Claim 1 or Claim 2, wherein the fuel cell further comprises a first plate (28) made from a porous material, the partition wall (28A) is formed in the first plate (28), and the downstream gas supply channel (33) is formed between the partition wall (28A) and the specific electrode (26C).

4. The polymer electrolyte fuel cell as defined in Claim 3, wherein the first plate (28) further comprises the upstream gas supply channel (32) which overlaps with the downstream gas supply channel (33), with the partition wall (28A) being sandwiched therebetween.

5. The polymer electrolyte fuel cell as defined in Claim 4, wherein the partition wall (28A) further comprises a through hole (34) which supplies the reaction gas in the upstream gas supply channel (32) to the downstream gas supply channel (33).

6. The polymer electrolyte fuel cell as defined in Claim 4, wherein the first plate (28) comprises a plurality of ribs (32A) which separate a flow of the reaction gas in the upstream gas supply channel (32) into a plurality of parallel flows and a plurality of ribs (33A) which separate a flow of the reaction gas in the downstream gas supply channel (33) into a plurality of

parallel flows.

7. The polymer electrolyte fuel cell as defined in Claim 4, wherein the first plate (28) further comprises a pair of jetties (32A) which guide a flow of the reaction gas in the upstream gas supply channel (32) into a substantially S-shape, and a pair of jetties (33A) which guide a flow of the reaction gas in the downstream gas supply channel (33) into a substantially S-shape.

8. The polymer electrolyte fuel cell as defined in Claim 3, wherein the pair of electrodes comprise (26B, 26C) an anode (26B) and a cathode (26C), the specific electrode (26C) comprises the cathode (26C), and the fuel cell further comprises a second plate (27) made from a non-porous material, the second plate (27) comprising an anode gas supply channel (31) which faces the anode (26B).

9. The polymer electrolyte fuel cell as defined in Claim 8, wherein the fuel cell further comprises a third plate (30) made from a non-porous material, and the third plate (30) comprises a coolant supply channel (29) facing the second plate (27).

10. The polymer electrolyte fuel cell as defined in Claim 8, wherein the second plate (27) comprises a coolant supply channel (29) which is partitioned from the anode gas supply channel (31).

11. The polymer electrolyte fuel cell as defined in Claim 8, wherein the fuel cell is laminated with a second polymer electrolyte fuel cell having an identical structure, and further comprises a separator (43) made from a material which does not permeate the coolant and the cathode gas, the separator (43) being interposed between the first plate (28) of the first fuel cell and the second plate (27) of the second fuel cell.

12. The polymer electrolyte fuel cell as defined in Claim 8, wherein the fuel cell further comprises a third plate (30) which is made from a non-porous material and is located on the side of the first plate (28) opposite to the cathode (26C), and the upstream gas supply channel (32) is formed in the third plate (30).

13. The polymer electrolyte fuel cell as defined in Claim 12, wherein the third plate (30) further comprises a coolant supply channel (29) which is partitioned from the upstream gas supply channel (32).

14. The polymer electrolyte fuel cell as defined in Claim 8, wherein the fuel cell is laminated with a second polymer electrolyte fuel cell having an identical structure, the second plate (27) of the first fuel cell comprises the upstream gas supply channel (32) and a coolant channel (29) which are partitioned from each other while facing the partition wall (28A) of the first plate (28) of the second fuel cell, and the partition wall (28A) of the second fuel cell comprises an impermeable portion (44) which is formed of impregnated resin to prevent a

coolant from permeating.

15. The polymer electrolyte fuel cell as defined in Claim 8, wherein the fuel cell is laminated with a second polymer electrolyte fuel cell having an identical structure, the second plate (27) of the first fuel cell comprises the upstream gas supply channel (32) and a coolant supply channel (29) which are partitioned from each other while facing the partition wall (28A) of the first plate (28) of the second fuel cell, and the first plate (27) of the second fuel cell comprises a porous potion made of a porous material and facing the upstream gas supply channel (32) of the first fuel cell, and a non-porous portion made of a non-porous material and facing the coolant supply channel (29) of the first fuel cell.

16. The polymer electrolyte fuel cell as defined in Claim 3, wherein the fuel cell is laminated with other fuel cells of an identical structure, the first plate (28) further comprises a first through hole (17) which constitutes an inlet manifold for distributing the cathode gas to the upstream gas supply channel (32) of each fuel cell, a second through hole (18) which constitutes an outlet manifold for collecting the cathode gas from the downstream gas supply channel (33) of each fuel cell, and an impermeable layer (100) formed on an inner circumferential surface of the first through hole (17) and the second through hole (18) and on an outer circumferential surface of the first plate (28), the impermeable layer (100) functioning to prevent the reaction gas from permeating into the first plate (28).

17. The polymer electrolyte fuel cell as defined in Claim 16, wherein a cross sectional surface area of the second through hole (18) is set larger than a cross sectional surface area of the first through hole (17).

18. A power generation device comprising:

a fuel cell stack (1) in which a plurality of polymer electrolyte fuel cells are laminated, each of the fuel cells comprising a membrane electrode assembly (26) comprising a polymer film (26A) and a pair of electrodes (26B, 26C) formed on both surfaces of the polymer film (26A), a downstream gas supply channel (33) facing a specific electrode (26C) of the pair of the electrodes (26B, 26C), an upstream gas supply channel (32) which supplies a reaction gas to the downstream gas supply channel (33), and is not facing the specific electrode (26C), and a partition wall (28A) which is made from a porous material, is arranged substantially parallel to the polymer film (26A), and partitions the downstream gas supply channel (33) and the upstream gas supply channel (32), the fuel cell stack (1) comprising a first inlet manifold (17) which distributes the reaction gas to the upstream gas supply channel (32) of each of the fuel cells, a first outlet manifold (18) which collects the reaction gas from the downstream gas supply channel (33) of each of the fuel cells, a second outlet manifold (36) which collects the reaction gas of the upstream gas supply channel (32) of each of the fuel cells, and a second inlet manifold (37) which distributes the reaction gas to the downstream gas supply channel (33) of each of the fuel cells; and

a blower (38) which forcibly supplies the reaction gas collected by the second outlet manifold (36) to the second inlet manifold (37).

19. The power generation device as defined in Claim 18, wherein the device further comprises a first external pipe (39A) which connects the second outlet manifold (36) and the blower (38), and a second external pipe (39B) which connects the blower (38) and the second inlet manifold (37), one of the first external pipe (39A) and the second external pipe (39B) being covered by a thermal insulation material.

20. The power generation device as defined in Claim 19, wherein the device further comprises a pressure regulating valve (19) which regulates a pressure of the reaction gas flowing out from the first outlet manifold (18).

21. The power generation device as defined in Claim 20, wherein the device further comprises a second pressure regulating valve (40) which regulates a pressure of the reaction gas supplied to the first inlet manifold (17).

22. The power generation device as defined in Claim 21, wherein the device further comprises a sensor (56) which detects a power generation load on the fuel cell stack (1), and a programmable controller (41) programmed to control an opening of the second pressure regulating valve (40) according to the power generation load to maintain a pressure difference between the downstream gas supply channel (33) and the upstream gas supply channel (32) constant (S5).

23. The power generation device as defined in Claim 22, wherein the device further comprises a first cutoff valve (47) which cuts off a flow of the reaction gas in the second external pipe (39B), a second cutoff valve (49) which discharges the reaction gas sent out by the blower (38) to the ambient atmosphere, and a main switch (51) which commands to start and stop operation of the fuel cell stack (1), and the controller (41) is further programmed to operate the blower (38) in a state where the first pressure regulating valve (19), the second pressure regulating valve (40), and the first cutoff valve (47) are all closed and the second cutoff valve (49) is opened, over a predetermined time period when the main switch (51) has commanded to stop operation of the fuel cell stack (1) (S8).

24. The power generation device as defined in Claim 23, wherein the device further comprises a third cutoff valve (53) which supplies the reaction gas to the blower (38) without passing through the upstream gas supply channel (32).

25. The power generation device as defined in any one of Claim 19 through Claim 24, wherein the device further comprises a liquid water trap (50) which traps liquid state moisture in the reaction gas which has flown out from the second outlet manifold (36) to the first external pipe (39A).